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Smoke Rings

The Late Sir Nigel Gresley

MODEL Engineers, and particularly those interested in locomotives, will learn with great regret of the passing of Sir Nigel Gresley, the Chief Mechanical Engineer of the London and North Eastern Railway. Sir Nigel, who was in his 65th year, was one of the most progressive railway engineers of his time. Apprenticed at Crewe works under Mr. F. W. Webb, and subsequently a pupil of Sir John Aspinall at the Horwich Works of the Lancashire and Yorkshire Railway, he had great traditions set before him, and he lived up to these in full measure. He produced his first "Pacific" locomotive in 1922 and in 1937 the one-hundredth engine of this type was completed. On that occasion he was presented with a silver model of the locomotive, and he then stated that he had been responsible for the design and construction of nearly 1,500 locomotives. He was a strong advocate of streamlining, and his "Silver Jubilee" engine in 1935 aroused widespread interest. The "Coronation," in 1937, and the later "Cock o' the North" and "Green Arrow" were other examples of the progressive character of his designs. He always showed a sympathetic appreciation of the work of model engineers and on several occasions visited our annual "M.E." Exhibition where he evinced great interest in the work on view. He was particularly pleased with the locomotives on the S.M.E.E. running track, and honoured the Society by acting as driver of one of the engines. His clever designs were a great inspiration to model locomotive builders, and L.N.E.Railway types have always been very popular.

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A Model Engineer in the Tool-room

HERE is an interesting note on the experiences of a model engineer who, some little while ago, took up service in the tool-room of an engineering factory. I quote from his letter. "I am pleased to say that I am getting on well in my war job at the factory, I tried to keep my knowledge under, with the result that I have been accepted into tool-room as a "fellow," and in consequence have been able to learn a great deal in one week; the second-in-command has taken to me and given me the run of his bench, which adjoins mine, meanwhile keeping a "fatherly" eye on me (he is nearly 4 years younger !) My word, what a difference perfect tools mean in getting a job done quickly and accurately. Such a simple thing as making a couple of 4 in. × $\frac{5}{8}$ in. × $\frac{3}{8}$ in. keys for a shaft coupling, done in quick sticks with a shaper and a surface grinder and a magnetic chuck, where at home I should have been struggling with a file and hacksaw for a few hours. I have been impressed with the methods adopted, such as an absence of marking-out, simply roughing and grinding one face, and then working from this with hardened parallels between the first ground surface and the machine bed or table, so as to get the immediate opposite face trued up, the finished thickness being measured by mike. I should have been putting the work on a surface plate and scribing a line all round and then machining down to the line and finally miking. Doubtless, in some cases marking-out will have to be resorted to. It is not a large shop, four toolmakers, a Government trainee, myself, two improvers, and two young apprentices. Every man has to be able to use every machine, i.e., a job is given to one, and then you have to decide how you are going to do it, and get on with it. It may mean, say, the power hacksaw first, then a shaper (heavy), then the light bench shaper and the lathe, perhaps some drilling, followed by a filing machine or a vertical router, with a little milling in an open-ended slot, finally some elbow grease, and then to finish up by hardening out." This is an excellent instance of a model engineer who has quickly settled down to the routine and the methods of the tool-room. When he returns to the simpler equipment of his own workshop, he will no doubt have once again to resort to many of the old-time processes he previously employed, but his experience of tool-room practice will have its effect, and it is more than probable that both the quality of his work and his enjoyment of his model making will be enormously enhanced.

* * *

James Watt's Model Organ

I HAVE often commented on the partiality of model engineers for the organ as a musical instrument, but it is news to me that the great James Watt himself built a model barrel organ in his boyhood days. I discovered this interesting fact when reading in the *Journal of the Institution of Mechanical Engineers* an account of the presentation of the James Watt International Medal to Professor Aurel Stodola of Zurich, in recognition of his valuable contributions to engineering science, particularly in connection with the design of steam turbines. Dr. H. L. Guy, Vice-President of the Institution, gave an account of Professor Stodola's career, in the course of which he said: "Watt was tone deaf, for it is said that he did not know one musical note from another, yet as a boy he made a model barrel organ, and in later life he mastered the theory of music so that he might construct pipe organs for Scottish churches. Stodola acquired considerable proficiency in playing such organs, and throughout his life found solace and refreshment in his beloved music." It is certainly very interesting to find how frequently a love of music, and in particular of organ music, plays a part in the cultural equipment of the masters of mechanics and engineering.

* * *

Contact Wanted

A READER, who is at present on active service and stationed in Northern Ireland, would like to get into touch with someone else who is interested in railways, full-size or model, in the Newcastle, Banbridge or Kilkeel districts of County Down. If this should meet the eye of any readers in those districts, would they kindly communicate with us?

Percival Marshall

★Model Aeronautics

The "Messerschmitt 109"

By Lawrence H. Sparey

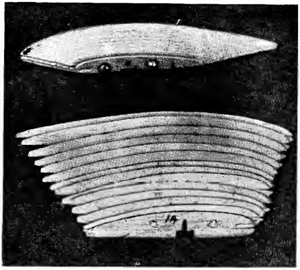


Fig. 42. Method of cutting the wing tips.

Wings

THE system chosen for the construction of the wings of the model is the orthodox one, consisting of solid balsa ribs connected by main and secondary spars. This method is very suitable for wings of plain taper shape, as no very great difficulty exists in cutting the ribs to the diminishing sizes, seeing that they vary by an even ratio according to their position in the wing. With other shapes, such as the "double ellipse" of the "Spitfire," this making of ribs entails the separate setting-out of each; a very tedious business. In wings of constant taper, however, there exists a simple method of doing the job.

Before attending to the details of assembly, it will be as well to glance at the photograph of the finished wing framework in Fig. 41. Here it will be seen that a very sturdy construction has been attained; a desirable feature on a scale machine which usually gets a good deal of knocking about. I was at some pains to devise a suitable wing tip, as the stubby and abrupt curve on the top surface pointed to difficulties when the covering comes to be applied. Eventually, I carved the tips from solid balsa, which I was loath to do on account of the weight, but which has been minimised by hollowing the tips out from underneath. The "solid" tip may be discerned in the picture. Both the leading edge and the wing butt are covered on the top surface with 1/32 in. sheet balsa.

* *Continued from page* 274, "*M.E.*," *April* 3, 1941.

As the ribs must first be made, our concern is now with Fig. 42, which shows the method employed. As will be seen, a number of strips of sheet balsa are clamped between plywood templates, the larger of which is made to the size of the largest rib, while the smaller conforms to the size of the smallest rib. The assembly is clamped together by long bolts and nuts, and the balsa strips carved and sanded to conform to the templates. When taken apart, we have a complete set of ribs of the correct sizes. Furthermore, we may be assured that the size and camber of the ribs are alike for each wing. In all, 14 ribs are required, although in the pictures of the construction only 13 ribs are shown. This is not an error on my part, but rib No. 1, which is the largest, is not evident in the pictures because it is used as a packing piece for recessing the press-studs for the wing attachment. Numbering the ribs from the small end, which we will call No. 14, all ribs up to and including No. 3 are of 1/16 in. sheet balsa. No. 2 is of ⅛ in. balsa, and No. 1 rib is again of 1/16 in. balsa. It will be noted that the slots for the main "T" spar, the secondary spar, and the leading edge, are cut in the templates, so that the slots may be cut correctly in the ribs themselves, while in the clamped-up stage. The recesses may be cleaned up separately with a broken razor blade when dismantled. If the templates can be made from sheet zinc or aluminium of about 16g., so much the better; in any case I have demonstrated that plywood may be successfully employed in the construction of the wings.

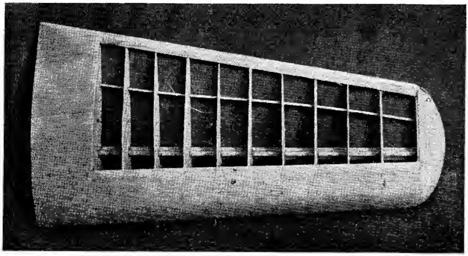


Fig. 41. The completed wing structure.

The sizes of the templates are given in Fig. 43, together with the main spar. Fig. 44 (which, by the way, was taken on one of the ten year old plates which I mentioned in a previous article) shows the first steps in assembly. Upon a sheet of paper the wing plan is marked out; the position of the main and secondary spars is indicated, and also the positions of all the ribs. Now, the spars are pinned down to the drawing, and the ribs cemented into place, and allowed to set while secured with pins. Fig. 44 shows this

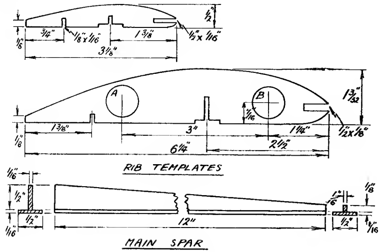


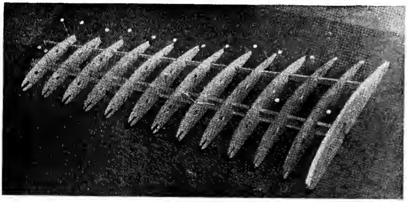
Fig. 43.

stage, although the pencil plan of the wing does not show owing to my using brown paper for clearness in photography. Next, the leading edge is cemented within the slots in the rib noses, and the trailing edge brought up to the rib ends and butt-glued. Allow the cement to set thoroughly before removing the structure from the building board. When freed, wing tips of 1/16 in. square birch are added. Bind two strips of the birch together with cotton and bend to shape in the steam from a kettle ; in this way, the tips for both wings will be identical.

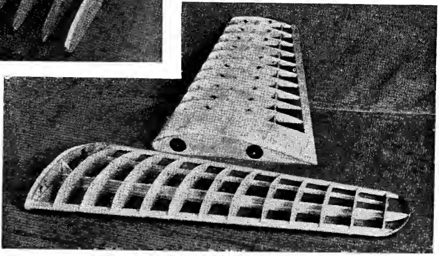
The picture, Fig. 45, shows the partially finished wings. The foremost wing has the birch tip affixed, and the corner blocks and the buttress block cemented between the root rib and the main spar. The other halves of the press-studs have also been sewn and cemented on. The wing furthest away has the balsa covering added to the wing root and also the packing rib has been cemented over the press studs so that they are suitably recessed to give a snug fit when the wing is secured to the fuselage.

It may seem unnecessary to call attention to the fact that wings are *left and right-handed*. Well, I am an old hand at the game, yet, in my anxiety to get a job finished, I have sometimes been guilty of building two right-hand or left-hand wings for the same model ! And so has every other model 'plane builder with whom I am acquainted ! It is easily done. The point is, of course, that the wing plan must be reversed for the opposite wing. A good plan is to build the first wing upon a sheet of good quality tracing paper, then, when the first structure is removed, to turn the paper over, trace over the lines with a pencil, and commence the second wing on the reverse of the paper. This will save setting out the plan twice. Also, when cutting the ribs between the templates, the second set of balsa strips should be packed between the templates in a manner reversed from the first. To explain. If you will glance at the top picture in Fig. 42 you will see that these ribs are for a right-handed wing ; that is, looking from the front of the aeroplane. To arrange for the left-handed wing, we will imagine that the balsa ribs have been removed ; the larger template will stay where it is, but the smaller template will be placed on the other side ; that is, furthest away in the picture. If you do not do this you will find that the angles at which the tips of the ribs are cut do not conform to the angle of the taper of the wing.

In applying the sheet balsa nose and butt covering, no difficulty will be found in making the sheet conform to the curved surface if it is applied as shown in Fig. 41. The solid balsa wing tips are best done by cementing roughly shaped pieces of solid balsa into the wing ends, and sanding to the correct shape when the cement is set. Then with a broken razor blade and pocket knife, the tips may be hollowed out as much as possible from beneath ; the thinner they can be made the better. When the wings have reached the stage shown in Fig. 41 they should be snapped on to the wing butts to ensure that they make a nice tight fit. Any tendency for the wing to be loose or to sag may



Above—Fig. 44. Commencing the wing building.



Right—Fig. 45. The wings in two stages of construction.

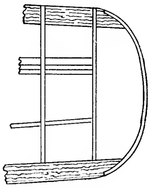


Fig. 46. Illustrating method of recessing birch tips into wing edges.

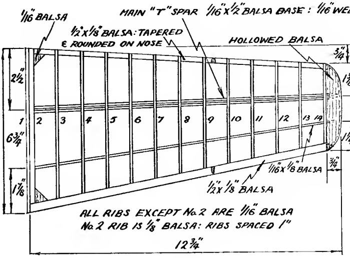


Fig. 47.

be counteracted by cementing thin strips of balsa to the wing butts, so that, although holding firmly, the press stud connection is always under a little tension. Finally, as usual, a good half-an-hour spent with a piece of fine glass-paper will repay the labour.

(To be continued)

Storing Your Fine Tools

THOSE readers who like to give their fine tools a good home when not actually in use may be interested in the following instructions for making a case, on the lines of the better class drawing instrument box.

First of all, decide what tools are to be kept in the case. Make a trial arrangement in order to decide what shall be the size of box required but do not place the various items too close together—allow one-half to three-quarters of an inch space between each tool. The depth of the box will be dictated by the thickness of the widest tool, but for a small micrometer, 3 in. or 4 in. square depth gauge, etc., the depth from underside of lid to inside of base need not be more than one inch. If a combination square is to be included, a slight addition to this measurement may be desirable. A ready-made box might be found in a cedar cigar box—one having dove-tailed corners for preference. Failing this the reader must make up his own box.

We now require sufficient paper pulp to fill the box. This is made by tearing newspapers into very small pieces and boiling them in water until you have a plastic mass. Squeeze all the water possible from this mass and allow it partly to dry.

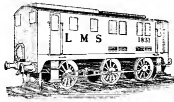
Give the inside of your box at least two coats of shellac, working it thoroughly into all the cracks and joints. If the box is not made water-proof it will warp from the drying pulp. After the varnish has dried, apply another rather thick coat of shellac and line the box with a loosely crumpled layer of newspaper, sticking it in place round the edges with shellac ; do not cover the uppermost side of the paper with the varnish. The purpose of this paper lining is to provide a wrinkled surface to act as an anchor for the pulp.

Fill the box to within about ½ in. of the top with the pulp and work it into a solid mass by tamping it down with a small block of wood. Level the pulp parallel with the top of the box. It is now necessary to form the depressions for the tools. Cover each item as closely as possible with waxed paper or other waterproof wrapping material. Wrap as closely as possible in order to preserve the contours of the tools. This done, force them down into the pulp for about half their widths, adopting your pre-arranged layout. The tools can be removed immediately the mould has been formed, but before removing, move them slightly endwise and sideways to allow the necessary clearance for the fabric covering. The depth of the depressions made in the mould will to some extent depend on whether the underside of the lid is to be similarly treated. If the lid has any depth which will permit the formation of a shallow mould, fill the lid with pulp at the same time as you fill the box. The lid might be filled to within, say, ⅛ in. of the edging. The mould in the lid can be formed as soon as the box portion is finished and is easily done if the box with lid closed on the tools is turned upside down. If the lower part of the box is now carefully opened the tools will be lying on the pulp in the lid and can be pressed down a little further by hand. Do not forget to move them to and fro to give clearance for the outer covering or lining.

Allow the moulds to dry but do not apply heat, since it is better to allow drying to take place naturally in a warm atmosphere.

If you wish to use velvet for lining your box, obtain the quality known as "jeweller's velvet" which is very thin and not too bulky for any recesses where it is necessary to use a double thickness. For fastening the velvet use *thin* carpenter's glue painted sparingly with a brush over the moulds. I lay particular stress on the wood "sparingly" because if the adhesive is applied at all thickly it will penetrate to the outside surface of the fabric and spoil its appearance.

The exterior finish of the box must be left to the taste of the maker. Varnishing will give a smart appearance, but I prefer to apply an oil finish. There is no doubt about it being waterproof and it does not show scratches or other signs of wear. Two or three applications of raw linseed oil well rubbed in would be quite satisfactory.—L. A. WATSON.



1831 . . .

*A $3\frac{1}{2}$-in. gauge I.C. Engine-driven Locomotive

By Edgar T. Westbury

BEFORE assembling the two cranks on the jackshaft, a pair of spacing bushes should be made to press lightly on the shaft, to take up the spaces between the ball-races and the cranks. These may be seen by referring to the section of the jackshaft assembly (Fig. 27), and it has not been considered necessary to give a detail drawing of them, as their dimensions are fairly obvious, the outer diameter being $\frac{1}{2}$ in. and the length 9/32 in., that is, just long enough to ensure that when the races, bushes and cranks are pressed home, the length will just check up to $4\frac{1}{8}$ in. over the crank faces. It will be noted that if the shaft has been left a little on the long side, as recommended, the two ends will protrude from the crank faces ; they will eventually have to be faced off flush, of course, but not yet, as their purpose has not yet been served. The bushes may be turned at one setting from mild-steel rod or tube, and it is worth noting that whenever two parts, which have to be fitted by pressing together, are made of unhardened mild steel, they should be lubricated before doing so, as there is otherwise a risk of scoring or seizure. This applies to some extent with any press-fitted parts, whatever metal they may be made of, if there is any likelihood of having to dismantle them again for any reason.

Transmission Skew Gear

It will be seen, from Figs. 26 and 27, that a skew gear of unspecified dimensions is keyed to the centre of the jackshaft. This forms the final member of the transmission system, and is arranged to mesh with a smaller skew gear at right-angles to it, in the torque converter which will eventually be mounted on top of the sub-frame. For the present, I do not propose to give precise details of this gear, firstly, because I have not yet succeeded in finding a certain source of supply of suitable ready-made gears, and secondly, because there is quite a fair latitude in the specification, dimensions and even the gear ratio of the gears which can be used here. The "provisional" specification of the gears as laid out in the drawings is as follows : Pitch centres, $1\frac{1}{8}$ in.; pitch diameters (transmission shaft), $\frac{3}{4}$ in. (jackshaft), $1\frac{1}{2}$ in., tooth angles, 60 deg. and 30 deg. to the shaft axis, respectively. Note that all these dimensions are necessarily *approximate*, because when calculating out the angles and dimensions to correspond exactly with standard circumferential pitch, some slight deviation from the stated sizes is found absolutely necessary. For this reason, the numbers of teeth in each gear are not rigidly specified, but it will be found that gears made to this rough specification will give a reduction ratio of 4 to 1. The gears should, preferably, be made of dissimilar metals, the best combination being a small gear of case-hardened steel, meshing with a larger gear of bronze.

For readers who may have somewhat similar skew or worm gears available, it may be mentioned that any gears which give a reduction ratio between about 4 to 1 and 6 to 1, and do not exceed the stated pitch centres, may be regarded as suitable, provided that they are otherwise of robust design and accurately cut It is, however, very essential to ensure that the action of the gearing is " reversible " ; that is to say, that it will transmit motion from the larger to the smaller gear, as well as in the other, and normal, direction. An ordinary worm gear, as most readers are well aware, will lock if an attempt is made to drive the worm by applying power to the worm wheel shaft, and such a gear is unsuitable for traction purposes, because it prevents the vehicle from coasting freely when the power is cut off. A multi-pitch worm, having the teeth at a suitable angle, however, and cut accurately, with smoothly-finished teeth, will transmit power in either direction, though its efficiency is less when used for increasing, instead of reducing, speed. All this is very elementary to those readers who understand the principles of gearing, but I have thought it worth while to point out these simple facts, in order to avoid the necessity of having to deal, later on, with queries from readers who are not so well informed.

This preliminary information will also, it is hoped, be of general assistance to readers who wish to be sure of being able to obtain the required material for the construction of the model. It is always somewhat of a problem to obtain special gearwheels, and I always make a point of avoiding them as far as possible ; but they are frequently quite indispensable, and it nearly always happens that such standard gears as are available are just a little different to what is required for a particular job. In the present case, I have followed my usual rule of keeping gearing down to a bare minimum, and the skew gears referred to here may be regarded as the worst snag we are likely to encounter in this particular department.

It is, of course, by no means impossible for the amateur to cut the gears himself, by means of home-made equipment on the lathe. I have solved my own problems in this way many times, and although the gears I have produced would have shocked a gear expert, they have invariably *done the job*, which is all that matters in most cases. Incidentally, if any reader, whether in the trade or otherwise, is in a position to undertake the cutting of suitable gears, or to supply something resembling them from stock, I should be grateful if he would communicate with me.

Meanwhile, there is no harm in temporarily assembling the jackshaft and sub-frame in order to enable the complete chassis to be erected for rolling tests, as they can be taken apart later on, when the necessity arises for completing the transmission system.

Quartering the Cranks

One of the most essential little details in the construction of any type of locomotive having coupled wheels, is the location of the pair of cranks on each axle so their angular relationship is exactly the same, for every axle in the coupled system. In nearly all locomotives, the two cranks on each coupled axle are situated at 90 deg. to each other, or " quartered," and although precise adherence to this angle is not of the utmost importance, it is most essential that any error which may be present should be the same for each axle, and that the " leading " crank should be on the same side in each case. Some types of locomotives conform to definite rules as to whether the near-side or off-side cranks should lead, but so far as I am aware, there is no definite ruling in this case.

Now, any operation which involves exact angular measurements is necessarily a somewhat delicate one for the amateur, and there are all sorts of possibilities of error involved therein ; moreover, errors made in this way are liable to be serious because they affect the inter-crank

* *Continued from page 292, "M.E.," April 10, 1941.*

distances, so that conformity with the fixed centres of connecting- and coupling-rod bearings is impossible. I have seen many model locomotives which would only run smoothly and efficiently with rubber coupling-rods ! For this reason, I advocate that particular care should be taken in quartering the cranks in this case ; not only because of the special importance of avoiding undue friction, as already discussed, but because, although the loco. is only six-coupled, the presence of the jackshaft makes it necessary to couple *eight* cranks together in complete co-ordination.

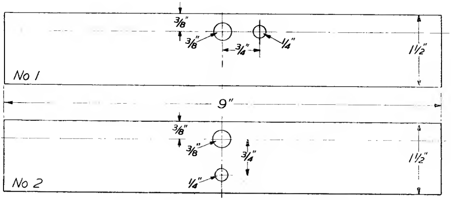


Fig. 34. Gauge bars for quartering cranks.

Quartering Gauge Bars (Fig. 34)

Several methods of quartering locomotive wheels have been described in THE MODEL ENGINEER at various times, some simple and others elaborate, but with all due respect to the originators of these methods, most of whom have forgotten more about loco. construction than I shall ever know, I have been unable to find a reasonably simple method which gives *positive* accuracy or uniformity. I have, therefore, devised a method of my own, which, while it may not be original, is certainly different from any which I have yet seen described.

Obtain two flat pieces of steel bar, about 9 in. long and $1\frac{1}{2}$ in. wide, both dimensions being arbitrary, though ample length and width are an advantage from the point of view of accuracy and handiness. The thickness should be not less than $\frac{1}{4}$ in., and both edges and surfaces should be as true as possible. A centre line is scribed at a distance of $\frac{3}{8}$ in. from the edge of each bar, and a cross line squared off across the middle of its length. At the point of intersection of these holes, a pilot hole is drilled then opened out and reamered $\frac{3}{8}$ in. dia. ; it should be a " spigot fit " on the ends of the jackshaft, which project beyond the cranks. Now take one of the track wheels, and by means of a tight-fitting bolt or dowel passed through the $\frac{3}{8}$-in. hole, attach it to one of the bars, with the crankpin hole in such a position that its centre is immediately over the scribed line ; then clamp it firmly in position. Spot through this hole with a $\frac{1}{4}$-in. drill, follow through with a reamering size drill and finally reamer the hole so that the crankpin, or a piece of $\frac{1}{4}$-in. stock rod, will fit accurately.

The wheel is then clamped to the second bar in a similar way, but instead of the crankpin hole falling on the line parallel with the edge of the bar, it is in this case disposed squarely across it and lined up to the cross centre-line. It is then again clamped up, the hole spotted through, drilled and reamered as before. The bars should then be clearly marked as to which side is to be used for near or off-side, also inside or outside (these particulars are only essential to avoid mistakes in the uniformity when dealing with the various axles). If they are used as directed, they will ensure that, while there may possibly be an initial error in the quartering, due to inaccuracy in marking or drilling the bars, there will still be very close agreement between the angular relationship of the pairs of cranks of all four of the coupled axles, which is the point that really matters.

It is desirable to deal with the quartering of the jackshaft cranks first, and as these cranks are located by means of the cross bolts in the webs, it is clear that the drilling of these holes may be regarded as a critical operation. The best way to tackle it is first to assemble the ball-races, spacing bushes & cranks, quartering them roughly, and by eye ; the main object in putting them all together is to ensure that no error in the endwise location is possible. Now attach the gauge bars to the cranks, using the projecting ends of the shaft, and either the crankpins, or pieces of $\frac{1}{4}$-in. rod, as locating spigots ; but—here is an important point—attach the plate which is intended for the *near* side, on the *off* side, and *vice versa*. The gauge bars should now be clamped firmly to the crank faces by any convenient means which will enable torque stresses to be applied without risk of shearing the crankpins, and then, by twisting or lightly tapping the bars, they should be aligned accurately. This can be done by sighting across them, or (assuming that the bars themselves are parallel) by resting them on a surface plate, and observing that they bear evenly, without rocking. The gauge bars may be used as a frame to support the shaft during the drilling operation, assuming that this is done in the drilling machine ; it may be a little awkward if only the lathe is available for drilling, but in this case, it is worth while to clamp the whole assembly to a flat piece of wood or metal. Only one crank, of course, will be in a suitable position for drilling the cross hole, and care is necessary to avoid any risk of snatching or shifting the shaft as the drill passes through the two parts. The hole should be drilled 3/16-in. reamer size, and carefully reamered in position, after which a tight-fitting bolt or dowel is inserted in the hole. Now remove the gauge bars and reverse them, that is to say, put them at the ends where they really belong ; line them up again carefully (this should not, strictly speaking, be necessary, but probably will be), and drill the second cross hole.

It will be advisable to make two special bolts for securing the cranks, as it is most essential that they should fit the holes really closely, a light tapping fit for preference. The heads may be round, and it will be advisable to use nuts rather smaller than the standard 3/16 in. or 2 B.A. ; say 3 B.A. size opened out.

Slitting the Cranks

Many readers may consider that if the cranks are made a light press fit on the shaft, and keyed by the cross bolts, no further security will be necessary ; but it should be remembered that the jackshaft will get some pretty hefty jolts, as it is called upon to transmit all driving loads, to say nothing of quite a few accidental shocks. I strongly recommend therefore, that the balance-weight end of the web should be slit sufficiently to enable the shaft to be drawn up to grip the shaft by the cross bolt. This conforms with the method used in full-size practice for components of this nature, also, in some cases, for valve-gear return cranks, etc. Referring to Fig. 32, it will be seen that a slit is cut in the crank, terminating in a $\frac{1}{8}$-in. hole at a distance of 11/16 in. from the crank centre. There is no particular difficulty in cutting this slit by means of a hand-saw, but there may be difficulty in making a *neat* job of it, as hacksaw

cuts often look very ragged, no matter what care is taken with them, and it is not easy to file out a narrow slit without making it abnormally wide. It is, therefore, recommended that the slit should at least be *started* (it cannot be completely cut) by means of a circular slitting saw, not more than 1-in. run in the lathe. The crank can be clamped to an angle-plate on the cross slide of the lathe, as shown in Fig. 35, at a suitable height to enable the saw to be used to the best advantage. It is permissible to allow the saw to run into the opposite side of the centre hole, so long as both cranks are treated alike, but it should not on any account run past the ⅛-in. hole which forms the terminus of the slit. If desired, the same procedure can be carried out at the back of the crank, after which the slit may be finished with a finely-set hacksaw, or an Eclipse " 4 S " tool.

A point of great importance in the use of all split-clamping methods is that, although they undoubtedly allow of some latitude in fitting, and ensure that the firm grip of the boss on the shaft is maintained in normal service, they should never be made an excuse for slipshod initial fitting. The extent to which the boss can be contracted by the clamping bolt is very small, and in any case, a contraction of more than one or two thousandths of an inch would distort the boss so that it would only fit at the two sides, instead of over the entire surface ; thus preventing a really firm grip from being obtained.

It remains only to face off the ends of the jackshaft to exact length, after which the entire sub-frame assembly may be erected, and the chassis put up for a rolling test.

Quartering Wheels

For pressing the wheels on their axles, some form of wheel-press is advisable ; a large parallel vice can be adapted for this purpose, but other and more suitable devices have been described in THE MODEL ENGINEER, and it is by no means difficult for the average amateur to construct something of this nature, which will be useful for hundreds of other jobs, besides the one in question. One of the wheels is pressed on to each axle first, and then the axle-boxes, together with the sub-frame, are threaded on in their respective places, and the opposite wheels on each axle taken each in turn, quartered accurately by means of the gauge bars, and pressed home.

In applying these gauge bars, the projecting end of the axle on one end, where the wheel has already been pressed on, is used to locate the centre, but at the other end, it will be necessary to make use of a short dowel of ⅜-in. rod, which can be inserted in the bore of the wheel, and is pushed out by the axle as the wheel goes on. It will thus be necessary to use a packing bush between the wheel centre and the jaw of the press, so that the dowel is free to come out. The bars should be aligned in the same way as for the jackshaft cranks, and in order to cope with any tendency for the alignment to become upset during the pressing-on operation, it should be done in two or three stages, taking a " squint " across the bars each time to check up. Some constructors may like to key the wheels by round dowels, inserted endwise on the intersection of the axle and boss ; this is quite good practice, though it may be regarded as unnecessary if the wheels are properly fitted—and if they are not, keying them is pretty hopeless, anyway. But if you do use keys, or dowels, fit them properly, as a botched-up key is worse than none at all.

It is now possible to assemble all the wheels and axle-boxes in the chassis, and to fit the connecting- and coupling-rods, when the results of these operations will be capable of practical test. If the fitting of all the crankpins, the spacing of bearings, and quartering of the cranks, has been carried out according to instructions, the chassis should roll quite freely on the floor or track without any necessity to gouge bearings out to an abnormal clearance. If not, " someone has blundered "—and this is one place where the constructor *can't* blame the designer !

Balancing

So far as I am aware, very little has been done in the way of checking or correcting running balance in model locomotives, and perhaps I am setting a precedent in recommending it in this case. There is, however, some reason to believe that many model locomotives might be very much improved by a little attention to their balance ; and in the present case, where the connecting- and coupling-rod weights are greater than usual, bad balance would undoubtedly make its presence felt. The question of compensating reciprocating weight—usually the most difficult problem in balancing—does not arise in this case, so it is only necessary to ensure that the balanceweights more or less exactly but, curiously enough, he also said that one reason his boilers coupling-rods. It is suggested that fairly good results will be obtained if one-half the connecting-rod weight is cancelled out on the jackshaft crank, the other half being distributed

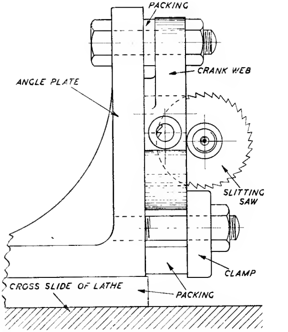


Fig. 35. Jackshaft crank set up on an angle plate on cross slide of lathe for slitting with circular saw. (Viewed from tailstock end.)

between the two main axles, and the coupling-rod weight cancelled by the third axle. This is not strictly the correct distribution, but should be near enough. The rod weights on the two sides should be exactly equal ; if not, the reason should be found, and the discrepancy corrected.

In order to carry out the balancing operations, each of the wheels and cranks should be dealt with individually, mounted on true mandrels and set up on knife edges ; the latter should be exactly level in their own length, and with each other. Weigh the rods, and make up some temporary weights in the form of discs, with a ¼-in. hole in the centre, so that they may be slipped on the crankpins with the assurance that their centre of gravity is massed about the throw centre. The weight of these should correspond with the selected proportions of the rod weights, thus : the weight applied to the jackshaft crank should correspond to *half* the weight of the connecting-rod, and the permanent balance weight of the crank should then be adjusted to produce

(*Continued on page* 340)

"RAINHILL'S" BOILER

A $3\frac{1}{2}$ in. Gauge "Rocket" type Passenger-hauler

By "L.B.S.C."

HERE are the promised drawings, plus a short description, of a suitable boiler for the "ancient and honourable." It is supposed to be bad practice to put new wine into old bottles; but a drop of new wine put into this particular old bottle, in the shape of a modern "inside," is going to be the exception which every rule is supposed to have. Eleven tubes, two of them carrying superheater elements, in a barrel only 3 in. diameter, would have probably caused our old friend, Mr. Alexander, to call loudly for the smelling-salts, as he said that more than one tube choked the draught; but, curiously enough, he also said that one reason his boilers made plenty of steam (on "spirits of wine") was because they had large-diameter chimneys and a separate blast-pipe for each cylinder. Shades of Lemaître—who said the big chimney and multiple-jet blast-pipe was a new idea? In case any novice or tyro beginner is hazy on this tube question, I might point out that there will not be any choking of draught in a boiler with a number of small tubes, provided that the total tube or flue area is properly proportioned to the firebox and grate. On the contrary, splitting up the stream of hot gases, instead of wasting them through the "core" of a single big tube, gives the boiler a vastly increased percentage of efficiency. I found that out by actual personal experience a quarter of a century ago. The rapidity with which "Rainhill's" boiler gets up steam, and the way in which it maintains full pressure, despite its comparatively small size, will come as a pleasant surprise to all who have not built a *real* Live Steamer before. I will just run through the principal points and details, and leave out the "routine work" which, as in the case of the engine part, has been fully dealt with in past notes many times.

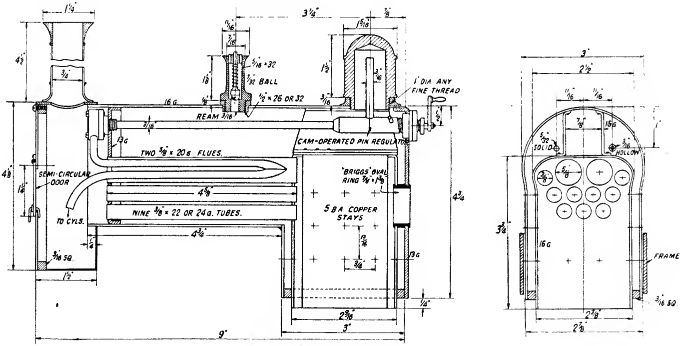
Barrel and Wrapper

This cannot be made from a split-and-opened-out piece of tube, as the firebox would not be deep enough, and would have to be lengthened by pieces attached at bottom—a "botchy" kind of job, anyway. Also, if you use a tube for the barrel, and a separate wrapper sheet, it means a "piston-ring" joint right around. Therefore, I recommend building it from sheet. A piece of 16-gauge copper $11\frac{1}{4}$ in. by $7\frac{3}{4}$ in. is needed. At 3 in. from one end on each short side, make a cut with the snips about $2\frac{3}{4}$ in. long, towards the centre. Bend the copper on the longer side of the snipped part, into a circle 3 in. outside diameter, cutting off the surplus to leave a $\frac{1}{4}$-in. lap joint. The copper on the shorter side of the snipped part hangs down almost straight, and forms the wrapper sheet. Put a few 1/16-in. rivets in the lap joint, fit a throatplate as per back notes, and braze both lap and throatplate joints, using easy-running strip spelter.

Followers of these notes won't need telling how to make an iron backhead former, and knock up the backhead over it.

Firebox and Tubes

Make your former for the end plates, and set out and drill the No. 40 holes in it for jigging off the holes in the tube-plate. The latter are first opened out to (small) 23/64 in. and reamed $\frac{3}{8}$ in. and (large) 39/64 in. and reamed $\frac{5}{8}$ in. Note where the firehole comes; not close to the crown sheet, as usual, but halfway down the backhead. This is O.K. for the given depth of firebox, and allows more room for fittings. A piece of 16-gauge sheet copper 10 in. by 2 9/16 in. forms



Boiler for "Rainhill."

the sides and crown of the firebox ; and if you take a second look at that whilst " in the flat," and think a minute, you will realise why this boiler is a fast steamer. Bend to shape, rivet to tube and door-plate flanges with just enough rivets to hold it in position, then fit the two crown stays, also 16-gauge material, and braze the lot, again using easy-running strip. Next, knock up and drill the smokebox tubeplate, and turn the flange ; fit the tubes in the firebox, put the smokebox tubeplate on temporarily to hold and space them, and silver-solder the tubes into the firebox, using common-grade or No. 3 silver-solder, or Johnson-Matthey's B 6 alloy. I've no shares in their company, but they sell jolly good silver-solder in varying grades, with suitable fluxes.

Assembly and Staying

Fit the bottom front section of the foundation ring, making it of 3/16-in. square copper-rod, well cleaned ; then insert firebox and tubes, rivet the crownstay flanges to the wrapper (three rivets in each will be plenty) and rivet the throatplate to the firebox tubeplate, with the bit of foundation ring in between. Put the smokebox tubeplate in, flange first, and enter it carefully until the tubes are all about 1/32 in. through. Then braze up, using easy-running strip for the smokebox flange, and silver-solder as above, for crownstay flanges and tube ends. Then insert the backhead, being mighty careful to fit the firehole ring as given in previous notes ; fit the sides and back of the foundation ring, and silver-solder the lot. Novices and other inexperienced coppersmiths had better use No. 1 grade silver-solder, or " Easyflo." On the drawing, I have not shown any fitting bushes on the backhead, except the regulator bush ; but you will need a couple of $\frac{1}{4}$ in. by 40 bushes for a water gauge, one ditto for a clackbox or check valve if the hand pump only is being adopted, or two for hand, plus eccentric-driven, pump. These can be put in any handy place ; on either side of the firehole, close to the edge of the backhead, is as good as any, for this engine ; and two big bushes on the top of the boiler (see sketch) for dome and safety-valve, must also be fitted and silver-soldered.

There are two longitudinal stays, as usual, solid and hollow, between the smokebox tubeplate and backhead. Nine copper stays made from $\frac{1}{8}$-in. wire rod and screwed 5 B.A., are put in each side of the firebox, and two in the front and back. These may be headed over outside and nutted inside, or headed inside and out, just as you please. Sweat over the heads and nuts with plumber's solder, in case of torn or ill-fitting threads. Tip—always use plenty of cutting oil, as used for turning steel (I use "Houghtolard " or " Vacmul A ") when screwing and tapping copper. Graphite is a good " second choice."

Fittings and Mountings

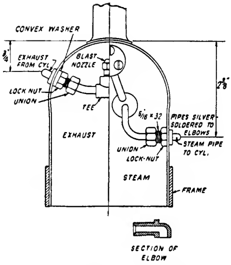
The safety-valve is of the usual cup-and-ball pattern turned out of $\frac{3}{4}$-in. brass rod ; the sketch gives the dimensions. The dome, which is first cousin to the one adorning St. Paul's, is turned up from a casting, or from a chunk of brass rod of 1 5/16 in. minimum diameter. Drill it out with a $\frac{3}{4}$-in. drill. You will probably have no fine-thread tap 1 in. diameter, so the thread will have to be chased ; or it could be made smaller, so long as there is enough room left inside for the steam-collecting pipe.

Any type of regulator as described in past notes can be used ; but I have shown the simple cam-operated pin-type, the valve of which is forced on to, or pulled away from its seating, by a pin working in a diagonal slot in the regulator barrel. Some of "Rainhill's" big sisters had a regulator operated in similar fashion, except that the valve was a three-wing mitre valve instead of a simple cone point. At the smokebox end, the steam pipe is fixed in the tubeplate by my usual type of self-locking flange, to which is screwed a $\frac{3}{4}$ in. by $\frac{1}{4}$ in. superheater header carrying two 3/16-in. elements of the spearhead-type, as shown in sketch. The usual swan-neck of $\frac{1}{8}$-in. tube, with blower jet, is also attached to the end of the hollow stay in the smokebox.

At the foot plate end, fit a water gauge, blower valve, and a couple of clack boxes all as described for the " Owl," only twice the size or thereabouts. You can also fit a steam gauge if desired, though big sister didn't have one, as dial gauges were not invented when she was "alive." Otherwise, set the safety-valve to blow off at 80 lb. by separate test, and use that for a gauge ; it will usually be blowing off, anyway, gauge or no gauge ! The firehole door is of the "oven"-type, with the usual latch and baffle plate.

Smokebox

The wrapper sheet of the smokebox is 18-gauge brass or steel, a piece $10\frac{1}{4}$ in. by $1\frac{1}{2}$ in. being needed. Bend it around the boiler barrel, and continue the sides straight down, to fit between the side frames. A make-up piece, similar to the boiler throatplate, is brazed in at the back, and a flat piece, also brazed in, forms the bottom. The front must be detachable, for getting at the pipes, unions, etc., so bend a length of 3/16-in. square brass rod, softened, to the shape of the front of the smokebox, and attach it to the wrapper by 1/16-in. rivets or screws ; the former look fine if you use about umpty of them at 3/16-in. spacing, and snap the heads outside the shell. The front plate is cut from 16-gauge material, and attached to the square brass by 1/16-in. or 10 B.A. screws all around. A semicircular hole is cut in the lower part of the front, opposite the barrel ; and a sheet-metal door, like the moon in first quarter, furnished with a couple of hinges at the top, is hung over the opening. It is kept shut by a simple catch, as shown in the sketch, and, of course, must close airtight.



Steam and exhaust pipe arrangements.

The chimney, which really is worth calling a chimney, can either be made from a $4\frac{1}{2}$-in. length of 13/16-in. brass or copper tube belled out top and bottom as described just recently, or it can be made from a straight piece of tube, with a cap and base turned from the solid and brazed on. If anybody wants to put a fancy top on, like a bird bath, or a wash basin, or any of the ornamental caps beloved of the

old designers, go ahead and welcome, it won't make any difference to the working of the engine. The chimney is attached to the smokebox by a few 1/16-in. round-headed screws, and no liner is, of course, required.

The completed smokebox fits over the end of the boiler barrel, which projects $\frac{1}{4}$ in. into it, and a few 1/16-in. (or 9 B.A. for preference; they are a little stronger) brass screws, can be put through both smokebox and end of barrel, where they overlap, to prevent any dissolution of partnership, as the boiler is not fixed to the frames at the rear end, on account of expansion. It is important to have the joint airtight, and the usual application of plumbers' jointing will be needed. If any tyro or other inexperienced worker has made a poor fit of the lower part of the back of the smokebox, so that daylight shows between it and the barrel, make a boiler band of thin sheet copper, about 1/32-in. thickness and 3/16-in. wide; and after putting a fillet of plumbers' jointing around outside the smokebox plate, between it and the barrel, put the band on as close to the smokebox as possible. Let the jointing dry out, and then scrape off the surplus. That will do the trick.

How to Erect and Connect Up

The boiler sits between the frames with the bottom of the barrel $\frac{1}{8}$-in. above them, and the front of the smokebox $\frac{1}{2}$-in. from the front end. Drill two No. 40 holes each side, clean through frame and lower part of smokebox, poke two 3/32-in. screws through from inside, and put nuts on outside. Screw a piece of $\frac{1}{4}$ in. by 1/16 in. angle brass at each side of firebox close to throatplate, so that the horizontal part rests on the frames, and hold them down by a couple of clips made from $\frac{1}{4}$-in. brass strip and screwed to frames. This will allow the boiler to slide but not lift.

The grate consists of nine $2\frac{1}{4}$-in. lengths of $\frac{1}{8}$ in. by $\frac{3}{8}$ in. black steel strip mounted on two bearers of $\frac{1}{8}$-in. silver-steel, each $2\frac{1}{2}$ in. long, with $\frac{1}{8}$-in. spacer washers in between the bars. File nicks in the bottom of the projecting side sheets of the firebox, for the ends of the bearers to rest in. The ashpan is a plain box bent up from 20-gauge steel, $2\frac{5}{8}$ in. long, $2\frac{3}{8}$ in. wide and $\frac{3}{4}$ in. deep, open at the back end. It fits right over the projecting bottom part of the firebox, nicks being filed to clear the grate bearers, and a $\frac{1}{8}$-in. pin put through the lot, holds it securely and admits of easy dumping after a run.

All we need now are some pipe connections, and these are very simple. Make four elbows as shown in section, two for 3/16-in. steam pipes and two for 7/32-in. or $\frac{1}{4}$-in. exhaust pipes. Silver-solder them to lengths of pipe, which you can best get by measurement from your actual job, using a copper-wire template. Drill 5/16-in. clearing holes halfway along the smokebox, at positions shown in cross section, to accommodate the elbow stems. The cylinder end of the exhaust pipe is furnished with an oval flange 1/16 in. thickness, fitting over the exhaust hole in the steamchest cover, to which it is attached by two screws. The ditto end of the steam pipe carries a circular flange just like the superheater header, and is screwed to the top of the steamchest cover, over a 5/32-in. hole drilled in same. Use 1/64-in. Hallite or similar washers for jointing.

All four elbows are nutted inside the smokebox, the exhaust fittings needing a washer, filed to fit the concavity of the plate, between it and the nut (see sketch). The free ends of the superheater elements are connected direct to steam elbows by the usual union nut and cone. For the exhaust, use a tee, with a short bit of pipe silver-soldered into each side, plus union nuts and cones, for coupling up to the elbows. The blast nozzle is turned up from $\frac{3}{8}$-in. hexagon rod, and screwed direct into the stem of the tee, the orifice being about 7/64 in. So much for the boiler; next week, all being well, final instalment dealing with tender and connections.

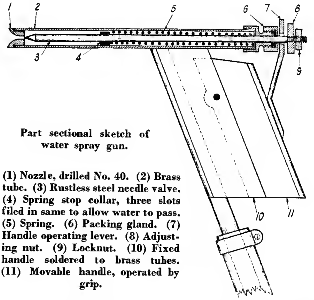
An Experimental Pump

By J. G. Bowring

AFTER reading the article on "Fire Protection," in the "M.E.," I wondered if my experimental pump would be of interest to anyone.

I had previously made a stirrup pump, working on "Artificer's" instructions, but varying sizes and design to suit materials at hand in the scrap box, and it's a great success. However, I imagined the need for something always ready to operate by one person, who may be living in isolated parts of the country. After searching for some time I came across an old 5-pint "Barthell" brazing lamp, the vaporizer of which was burnt out. The container was cleaned and examined, new washers fitted to pump and filler cap, pressure gauge repaired, and on testing was found to be O.K.

The old vaporizer was removed, also feed-pipe taken off at top of the main screw-down valve, and in its place I turned and fitted a connection for rubber hose. Then I made up the water spray gun (as sketch) and fitted this to the other end of hose.



Part sectional sketch of water spray gun.

(1) Nozzle, drilled No. 40. (2) Brass tube. (3) Rustless steel needle valve. (4) Spring stop collar, three slots filed in same to allow water to pass. (5) Spring. (6) Packing gland. (7) Handle operating lever. (8) Adjusting nut. (9) Locknut. (10) Fixed handle soldered to brass tubes. (11) Movable handle, operated by grip.

A hanger to carry the coil of hose when not in use, was made from $\frac{1}{2}$ in. half-round iron and fitted to the stud which previously carried the spirit cup for starting the blowlamp. All I have to do now is fill the container about 2/3 full with water and pump up to about 45 lb. on the gauge. On gripping the handle of the spray gun, the needle valve is lifted off its seat, slight pressure on the handle gives a spray, and full pressure the jet. The needle valve is quite tight when handle is released and holds full pressure with main valve open. Of course, a pump of this type is limited to about $\frac{1}{2}$ gall. of water, when it becomes necessary to re-fill and re-pump, but certainly $\frac{1}{2}$ gall. sprayed on a fire at the *start* is better than none at all. It can be placed at the bedside by night and left fully charged, ready at a moment's notice. No doubt there are numbers of these large brazing lamps lying idle in home workshops, which could be converted to these little pumps for the duration of the war and easily restored to their normal duties after.

[This device would seem to be quite satisfactory within its limits. It would be useful in keeping a fire from spreading too far, while somebody goes for the regulation stirrup-pump.—ED. "M.E."]

*RAILWAY SIGNALS

Standard Semaphore Types used in Pre-grouping Days

By O. S. Nock, B.Sc., A.M.I.Mech.E., M.I.R.S.E.

No. 16. Highland Railway

THIS line, like its neighbour in the mountain fastnesses, adopted an arm and spectacle based on the standard pattern of one of the large signalling contractors; but while the North British used the Stevens type, the Highland used that of McKenzie and Holland. This again is quite a distinctive *ensemble*, set off by a most ornate addition to the already diverse array of pinnacles described in this series. The Highland used both wood and lattice masts, the latter being of McKenzie and Holland's own brand of the inconspicuous variety, but for the purpose of this article, the wood posts only are illustrated.

Fig. 1 shows a typical one-arm signal. Beginning at the top, the pinnacle calls for special mention; the lower part, including the fluted watershed portion, is cast iron, and the long tapering finial is made up out of sheet zinc. Fig. 2 shows the pinnacle in plan, and the shape of the fluted portion.

Passing to the arm fittings, the arm plate is reminiscent of the Great Eastern pattern, though the shape of the spectacle glasses is something quite new, in that the upper and lower ends are not semicircular, as is more usual. Dimensional details of the arm and spectacle are shown in

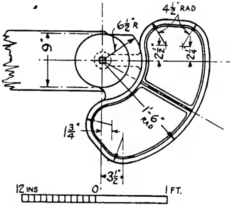


Fig. 3.

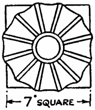


Fig. 2.

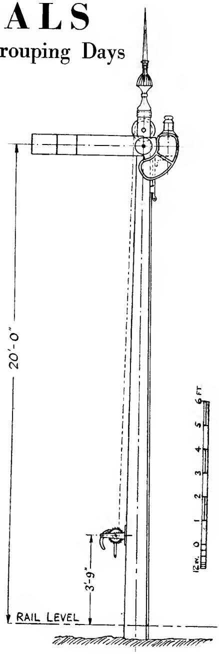


Fig. 1.

Fig. 3. One of the most interesting features of Highland signals, however, was the lamp winding-gear. This arrangement was used to obviate the need for a man to climb to the top of the post to trim and refill the lamp; the winding-gear allowed the lamp to be lowered to the foot of the post. This gear was also used on the Great Northern, though not to the same extent.

The general scheme of things can be seen by reference once again to Fig. 1. There is a winch, with ratchet gear, at a convenient height above rail level; the chain is carried over a pulley mounted in a slot cut in the post just above the arm spindle and attached to the sliding lamp carriage. An enlarged view of the ratchet gear is given in Fig. 4, and the lamp carriage and adjustable lamp bracket are shown in Fig. 5. The carriage is a fairly long casting, having two projecting lugs at the back; in each of these lugs is cast a T-shaped slot, that engages the head of a vertical rail extending to the bottom of the post. The lamp bracket itself is in two parts, a corner-piece and an adjustable lamp-carrier. The corner-piece casting has two long slots, for the bolts of the carrier; the latter is a tray supporting only a small portion of the lamp, the main support for which is provided by the spike.

In the case of posts carrying home and distant arms, arrangements are made for the winding of both lamps simultaneously. The distant arms, by the way, were usually spaced 6 ft. below the homes. The ladder has been omitted from the general arrangement drawing, Fig. 1, in

* Continued from page 294, "M.E.," April 10, 1941.

Fig. 6.

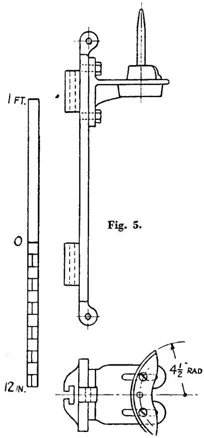


Fig. 5.

order that the lamp winding gear should be shown as clearly as possible, but there were no special features about the ladder ; the usual type was 12 in. wide, having a ring at the top, even on really tall signals. The ladder arrangement on a short post is shown in the photograph reproduced in Fig. 6. This illustrates a siding signal, with the arm only 2 ft. long. ; the locomotive alongside is heading a goods train that has been side-tracked for an express to go ahead.

Fig. 7 shows, in the group of signals on the near bracket, a different kind of subsidiary arm. This is a shunt signal similar generally to those formerly used at Waterloo, L. & S.W., on the G.E.R., and elsewhere ; the Highland variation has a letter S mounted in the middle of the arm. Several varieties of bracket construction were to be seen on

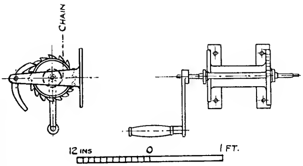


Fig. 4.

the Highland railway. **In** places, nothing more elaborate than the characteristic Scottish design, illustrated in The Model Engineer for October 24th, 1940, were to be seen. The signal bracket at the end of the platform in Fig. 7 shows another kind, with cast spandrel brackets, and in the background in the same illustration is a gantry, typical of McKenzie and Holland's work, that savours more of the Great Northern type of lattice-iron structure.

A final item, not directly associated with the semaphores themselves but a distinguishing feature of Highland Railway signalling, was the great height above ground at which the signal wires were carried—often over 6 ft. This, no doubt, was a precaution against snow troubles.

(To be continued)

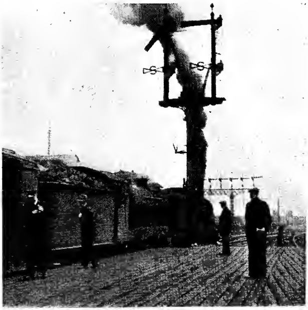


Fig. 7.

Experiences with model SPEED BOATS

By H. Scamell

SPEED-BOATS! What pleasant memories the mention of this word brings back to me: evenings of concentrated effort to get the boat ready, early morning risings to prepare for the trip to some regatta for a day's real sport, and a pondside discussion on matters pertaining with members of clubs from near and far—chaps one has perhaps never seen before, but pals at the instant of meeting.

All these thoughts, and many more, crowd into the mind at this time when the game is barred to us, but—roll on Peace! I have been making and running speed-boats for about five years altogether, my interest being first aroused 'way back in 1924, when the remains of *Sunny Jim* were shown at the "M.E." Exhibition.

Strangely enough, I started making a boat without intending to do so!

When a speed-boat design appeared in the "M.E." in an article by Mr. H. A. Cox (January 4th, 1934), I started enlarging the small scale drawings as a pastime, when home from work with a heavy cold, and before I realised it, the keel was made, and fitted to the building jig, and away we went. Nearly 1,000 hours were spent in building this hull, spread over a period of ten months; my idea was to do a good job of work rather than to obtain a speed-boat hull. However, having finished it, my thoughts turned towards engines, and a set of castings for the Grayson 30 c.c. o.h.v. petrol engine were obtained and machined on the 4-in. Drummond lathe. When completed, several evenings were spent in getting the thing to run; later, a finned head, oil pump, new cams, and new carburettor were made and fitted, and in this condition the engine drove the hull at 23 m.p.h.

It may be of interest to mention that no water suitable for speed-boat running exists in Salisbury, so that a pole was made from water-pipe and angle iron, and a trip made to a pond near Minstead in the New Forest for trial runs.

About this time, Mr. Westbury published the drawings for his "general purpose 15 c.c. o.h.v. engine, so at the next

Two photographs of Mr. Scamell starting his boat *Ark* at a provincial regatta shortly before the war.

Exhibition, a set of castings for the "speed" edition of this engine was purchased, and in the course of time (actually 550 hours of spare time), the engine was made.

Some of my friends dropped in occasionally and advised me to "chuck it" and get out and enjoy myself—nit-wits! To some people, "model engineers" seem a bit "cuckoo," working away like blazes when they could be having a good time; but so far as I am concerned, I can devote no end of time to making something for the sheer joy of doing so, or for giving someone pleasure, but I should need to be really hard-up to devote my spare-time earning money by making things that did not interest me!

But to get back to engines and boats; this engine has ball-bearings to crankshaft, oil pump which feeds big-end bearings and valve rockers, connecting-rod of R.R. 56 alloy, die-cast piston, and 60 degrees inclined valves in cylinder-head; the cams are of the constant acceleration type, and were milled by the method described some time later by Mr. Chaddock. The method was shown to me, however, by Mr. J. E. Brown, who also designed the cams.

This engine has always been most reliable on the bench—it recently started at the first swing after six months' idleness—but has had a nasty habit of stopping when driving the boat at regattas. The cause of this trouble has never been really discovered, although I think Mr. Westbury would soon eliminate it. I am now making the Atom Mark IV carburettor, in the hope and belief that this will cure the trouble; just to make this job more interesting, I am attempting to die-cast the components.

The hull into which this engine is fitted is a copy of Mr. Westbury's *Golly*, and at the first public appearance it won the 15 c.c. race at the Southampton Regatta in 1938 at 28½ m.p.h.—and didn't I feel proud!

I began to feel that the job was easy, and that the fellows who had been at the game for several years without much success were not trying, but I soon realised that my success was due to the pioneer work which these people had done, and that I was reaping the reward; anyway, my pride received a shock in due course, as I have never succeeded in obtaining such a speed since, in spite of altering the planing angles on the hull, fitting new propellers and fiddling with the engine!

In an effort to find out what the engine was producing in the way of b.h.p., the hydraulic dynamometer described by Mr. Westbury in July, 1935, in these pages, was made up, all patterns and castings being produced at home, and this has been used to show that 0.48 b.h.p. is produced at 6,500 r.p.m., which is not good when one considers 0.9 b.h.p. obtained by Mr. Westbury with his version of this engine.

The foregoing remarks only briefly describe the work carried out in the construction and running of my boats, but I can honestly say that all of it has been most enjoyable and instructive.

In conclusion, I would like to take this opportunity to pay tribute to the versatility and thoroughness of design exhibited by Mr. Westbury, who, in my estimation, is a marvel—his subjects are legion.

Again, roll on Peace—and let's get back to it in earnest!

Lathe Improvements

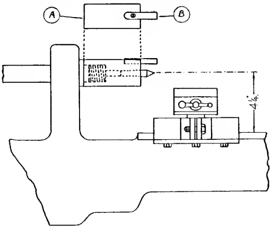
By Max Lewitt

In response to the slogan "GO TO IT," I replied to an advertisement in the local paper, offering small lathe work to model engineers. The work proved to be the turning of small plug gauges from ¼ in. to ⅝ in. diameter in silver-steel; all work to be turned on centres and to be within a tolerance of 0.003 in.

The tolerance figure did not present much difficulty, but dealing with 3 in. pieces in a lathe without compound slide rest, and having a 4 in. gap in the bed, was a problem.

I have often wondered why makers of this class of lathe do not arrange for the saddle to travel closer up to the face plate, as the provision of a so-called gap (in my case only about ½ in. below the machined surface) is a doubtful asset, and few model engineers ever make use of it. A further trouble with my lathe was the lack of overhang of the tailstock mandrel, which meant that without having the mandrel projecting to an extent causing it to spring, I was unable to obtain more than 1 in. of movement of the saddle. This was a hopeless proposition, as it involved constantly changing the tool position.

This difficulty did not arise when using a chuck, as the overhang of the latter brought the work well within range of the saddle movement. It, therefore, became necessary to consider extending the head stock mandrel by means of a nose piece of such a length that the job was brought clear of the gap in the bed. There was the additional difficulty of driving the work, as the ordinary catch plate and carrier could not be used owing to their fouling the cross slide.



The attached sketch shows how all these difficulties were overcome. An extension piece (*A*) was screwed on to the mandrel nose and made 1 in. shorter than the overall length of my chuck; this difference was made up by the length of the centre and the thickness of the carrier, the limit of the tool travel then being about the same as when using the chuck. Instead of a catch plate, a piece of key steel (*B*) was fitted as shown. This was sunk nearly flush with the circumference of the extension piece to allow it to clear the top of the cross slide. Carriers were made up from short lengths cut from 1 in. round bar bored to suit the diameter of the work, and drilled and tapped to take an O.B.A. set-screw. This screw both held the job and acted as a driving pin.

To ensure the maintenance of accurate centres as called for in the final grinding of the work, the lathe centres were annealed and turned up to the correct angle and re-hardened, but I made the discovery that while this may be all right for the dead centre, which in my lathe is adjustable, the slight warping which takes place during the hardening process is sufficient to throw the live centre out. Not being in possession of a grinder, the only alternative was to turn the live centre up and leave it soft. This was done, and after several months of fairly constant use the centre is still true and unworn.

To veteran readers the above description may appear long-winded; but I am passing it on for the benefit of tyros like myself.

A Vernier Height Gauge

By J. Latta

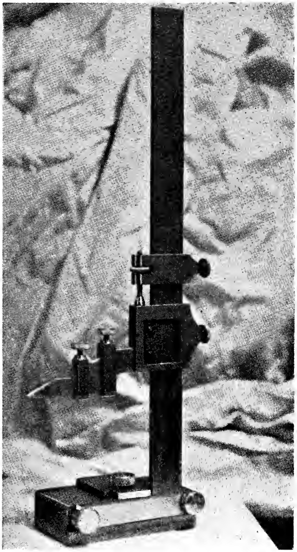


Fig. 1.

A TIME arrives in the career of most model engineers when they feel the limitations of rule and caliper measurements, and invest in a micrometer.

This useful tool, if wisely used, should result in a considerable improvement in the accuracy of the work turned out in the lathe. But as time goes on the restrictions of a 0-1-in. range begin to be felt, and the question is: What is the next step?

A series of micrometers to give a range up to 6 in. would be desirable, but the cost is often out of the question.

In my opinion, the most useful measuring instrument that can be bought after the 1-in. micrometer is a vernier sliding caliper gauge with a range of about 6 in.

Unfortunately, they are by no means cheap if of first-class make, and as with all tools of this description, it is money wasted not to buy the best.

It will cost at least twice what the micrometer did, but its possession extends the range of accurate measurement up to six inches, and in addition, it has possibilities of greatly extended usefulness if it can be used as a height gauge.

This conversion is so obvious that some makers construct their gauges so that they can be reasily altered for the purpose, but in the majority of cases this is not so.

Some years ago, I was lucky enough to acquire a 6-in. Starrett vernier caliper in new condition at a bargain price, and I soon converted it into a height gauge, as shown in Fig. 1.

The conversion is quickly made when required, and the caliper is not spoiled for its normal purpose.

The photo. pretty well explains itself, but the essential parts are a heavy mild-steel base block cut away on one side to take the fixed jaw of the gauge, which is clamped to the block by the two clamps shown; and a scribing blade held to the moving jaw.

The side and bottom faces of the block against which the jaw is held must be adjusted by careful filing until the beam of the gauge stands truly vertical, when held in position by the two clamps.

The underside of the block is, preferably, recessed in the centre.

The block should be case-hardened, and after lapping the underside on a piece of cast-iron with fine emery to remove any distortion due to the hardening, the beam should again be checked to see that it is still vertical.

Any small errors in this respect can be corrected on the base by the use of a carborundum slip.

Note that the position of the clamps must be chosen, so that when they are tightened up no strain is brought on the gauge, and no clamping should be done on the measuring surfaces of the jaw.

The marking blade, which is attached to the inner side of the movable jaw by two slotted bridles of mild steel, is best made of high-speed steel, but if this is not available, ordinary cast-steel can be used, although it does not hold its edge quite so well as high-speed.

Both top and bottom edges of the blade must be lapped flat and parallel.

To avoid the possibility of damage to the tip of the moving jaw on the curved surface used for inside measurements, a tiny shaped pad of brass is slipped under the tip of the screw to protect it.

When sharpening the blade, only the bevel should be ground. The flat underside of the blade must never be touched, as this is used for height measurements.

The principle is the same as sharpening a joiner's chisel.

At first sight a vernier height gauge would appear to have no special advantages except accuracy, when used for ordinary marking-out, over an ordinary scribing block and rule.

But a short experience will soon convince one that is a time-saver too. It is much quicker and easier to set it by lifting the whole gauge up to the light than to adjust the pointer of a scribing block to a rule with the block on the surface plate.

All dimensions must be decimalised, of course, but this is generally a convenience if there is much adding or subtracting of sizes to be done.

Figs. 2 and 3 show further applications of the vernier height gauge to lathe work.

In Fig. 2 the timing-case casting held in the machine vice has been bored with two recesses which have to be held to an exact centre distance.

The correct setting of the job on the lathe faceplate is checked by the height gauge, which measures the height from the boring table to the machined top face of the casting, which is in contact with the upper vice jaw.

Of course, the actual height from the boring table is not of direct interest, only the difference between the two heights when the job is set for boring the two holes.

In Fig. 3 the problem is a similar one, but in this case the crankcase casting has been bolted to a rectangular aluminium jig plate for convenience of holding and machining.

This jig plate has two edges machined at right-angles, and one edge is kept closely in contact with the mild-steel strip bolted to the upper right-hand corner of the faceplate.

By sliding the jig up and down the strip, the various holes and spigots in the work are all kept in line.

The correct locations can either be checked by the height gauge working on the edge of the plate, or alternatively, the distance from the fixed stop, seen on the left, to the edge of the plate, can be measured directly by the vernier caliper, using the inside measuring points.

Incidentally, an aluminium jig plate of this kind is very little trouble to make and machine.

The one shown was cast in the lid of an old square tin with the corners luted with clay ; the material being a couple of old motor pistons melted in an iron ladle in the sitting-room fire.

(Caution ! Choose a time when the wife is out of the house.)

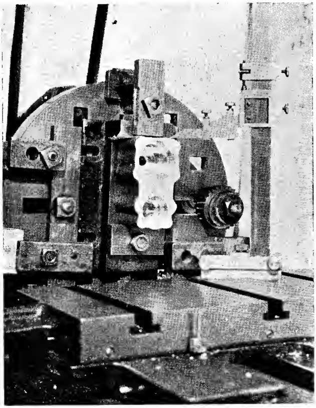


Fig. 2.

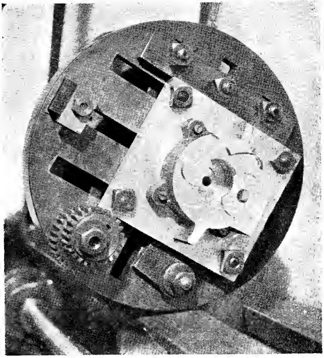


Fig. 3.

From these few illustrations it will be seen that the possession of a vernier caliper opens up great possibilities for accurate lathe work, quite apart from its ordinary use for direct measurements, and it will soon prove to be an indispensable item of the measuring kit.

Making Reamers

Very serviceable reamers for use in the lathe or by hand can be made from discarded motor car or lorry drive shafts, utilising the splined end which engages the crown wheel assembly in the case of an axle shaft, or the end of a solid type carden shaft employed on old-type Morris cars and similar.

A splined end should be selected of suitable size and having as large a number of splines as possible, and cut off long enough to form the shank, either parallel or with a morse taper as desired. The latter is very useful for lathe work, as the reamer can be held in the tailstock spindle.

After turning to size between centres, allowance being made for grinding after hardening if this means is available, the splines are backed off clearance by setting up in the milling machine or shaper, or, failing this, they can be carefully filed to shape.

The steel of which these shafts are made hardens up well if heated to a good cherry red and quenched in luke-warm water. Care should be taken to pass the tool vertically into the water to obviate distortion as much as possible, the temper should then be let down to a light straw colour, and the cutting edges finished off with an oil-stone before use. Reamers made up in this manner have given excellent service on non-ferrous metals and mild steel in the lathe. When used for the latter, the speed should be moderate and cutting oil used. This not only prolongs the life of the cutting edges, but improves the finish on the work.—H. W. Attree.

*A CAPSTAN ATTACHMENT for Small Lathes

A device for the expeditious and accurate quantity production of small turned parts in the home workshop

By " Ned "

Capstan Slide Plate

THIS is made from a piece of flat steel $6\frac{5}{8}$ in. long by $3\frac{1}{2}$ in. wide and $\frac{3}{8}$ in. thick (Fig. 6). A piece of boiler plate will serve the purpose, provided that it is reasonably true, or can be made so. The plate should be made as flat as possible by filing and scraping on both sides, using a surface plate or a thick piece of plate glass for a reference plane. The countersunk holes for the screws which secure it to the slide cross-bars should then be drilled, and the latter clamped to the plate in their correct location, the slide bars also being inserted through the holes, after which the holes can be spotted, drilled and tapped to take the screws.

In order to locate the hole which receives the capstan post, so as to ensure its accurate alignment with the lathe centres, it is advisable to assemble the complete slide frame and attach it to the bed. Then set up a rigid mandrel to run truly in the lathe chuck, and long enough to project over the top of the capstan slide plate; if necessary, take a skim over the mandrel to make sure it runs truly. Now set a square on the plate at right-angles to the lathe axis, and bring the edge of the blade up to make contact with the mandrel. Scribe a mark on the plate where the end of the square-blade comes (or the end of the stock, if the blade does not come right to the corner). Repeat the procedure the other side of the mandrel, and then bisect the distance between the two marks, which will give the true centre-line for the post. In order to check up on any possible errors, the procedure may be repeated at two or three points along the slide plate, or with the latter at various positions on the slide bars. Observe the greatest care in drilling and tapping the hole, so as to ensure that it lies correctly on the centre line, and is perfectly square both ways with the surface of the plate. The complete capstan slide may now be assembled on the slide bars, the cross-bars of the latter driven on and pinned as previously described, and the frame clamped to the lathe bed. If it is found that the capstan slide moves too stiffly on the bars, it may be lapped in by applying metal polish or similar fine abrasive paste to the bars and working it backwards and forwards. When finally fitted it should work quite freely and smoothly, but with no perceptible shake at any point in its travel.

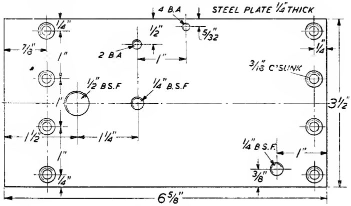


Fig. 6. Capstan slide plate (1 off).

Capstan Post

No special instructions should be necessary for the machining of this component, which is turned between centres from a piece of mild steel bar to the dimensions shown in Fig. 7. The threads on both ends should be screwcut in the lathe, so as to ensure that they are perfectly true with the axis, and that at the lower end should be undercut adjacent to the shoulder and the latter faced off truly so that it will bear firmly against the plate when the post is screwed home. As the post is to be a working fit in the bore of the capstan head, some constructors may prefer to machine the latter first, and fit the post to it.

Clamping Lever

This may be made from the solid without a great deal of difficulty, by first roughing down a piece of 1-in. bar to a little over the maximum diameter of the taper shank (do not taper it at this stage), and if desired, a little extra length may be turned down to a smaller diameter to take a supporting centre. Reverse the work, holding it by the shank to form the spherical boss, and after roughing the latter to approximate shape, finish it by hand tools, using a radius gauge to check up. When a satisfactory appearance has been produced, the job is again reversed, the surface of the boss being protected from marking by the chuck jaws by means of a strip of copper bent round it, and the shank tapered and rounded off at the ends.

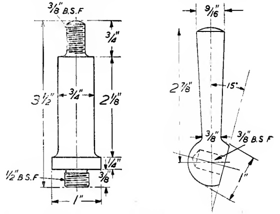


Fig. 7. Capstan post and clamping lever (1 off each).

The lever is then held crosswise in the 3-in. jaw chuck, gripping it over the boss with the shank inclined backwards towards the chuck face at approximately 15 deg. In this position the boss can be faced, drilled and tapped to fit the top end of the capstan post.

No detail drawing of the washer which is interposed between the lever and the capstan head has been considered necessary, as it presents no special features, but it should be large enough in diameter to provide a good bearing on

* *Continued from page* 312, " *M.E.*," *April* 17, 1941.

the face of the head, and thick enough to withstand distortion when the lever is clamped down. The lever should not project forward under these conditions, and it may thus be found necessary to adjust the thickness of the washer, or add a thin shim, so that it comes in a suitable position.

Capstan Head

Either a casting or a solid piece of iron or steel bar may be used for this part, the former being recommended, as entailing less heavy machining. It should first be set up in the chuck, gripping it over the lower spigot, to face the

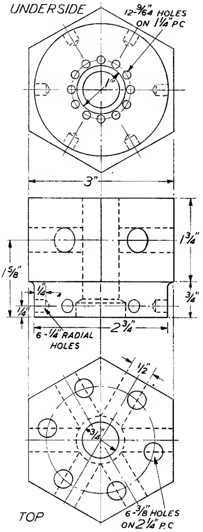


Fig. 8. Capstan head (1 off).

top, after which it is reversed, and bedded firmly against the chuck face, for facing the lower end, turning over the spigot, and boring the centre to fit the post. While thus set up, a line should be marked around the spigot to locate the height of the locking-pin holes, and if any form of indexing device is available, they may also be marked out for angular position, the greatest possible accuracy being observed in this operation. The relation of these holes to the flat facets of the head is also important. It may here be remarked that, even if the lathe head is indexed, simply using the index as a guide to *scribing* the centre lines of the holes is hardly good enough, because with all the care in the world, errors often occur when drilling to a marked line. A very much better method is to spot the holes by means of a drill spindle held in the tool post, on the centre line of the lathe. If such a fitting is not available, a good plan is to mount a centre punch horizontally in a light holder, the end of which can be held in the tool post, so that the punch is on the centre level. When the work is indexed into position, the punch is brought up so as almost to touch it, when a sharp tap on its head with the hammer will spring the holder sufficiently to produce an indentation which will locate the drill point positively.

The same methods may be employed for marking out the twelve 9/64 in. holes in the base of the capstan head, which are pitched on a circle of $1\frac{1}{4}$ in. diam.; and these also should be marked out before removing the capstan head from the chuck.

In order to machine the facets of the head, it is desirable to set it up on an angle-plate mounted on the lathe faceplate. A dummy post should be made to fit the bore of the head, and bolted to the angle plate so that the head can be rotated on it without disturbing the general setting. It is also very desirable to rig up some kind of an indexing pin, similar to the locking gear employed on the capstan slide itself, so that the facets can be located in their true relation to the locking holes. Note that as the particular capstan station in use is located by means of the hole *on the opposite side*, the same conditions must be observed when locating the head for machining the facets. All this may seem quite a lot of trouble, but the pains taken to ensure accuracy at this stage of the proceedings will make all the difference between a workmanlike job and a makeshift. In this particular operation, the essential point is the angular setting of the head ; there is no need to take great pains to set up the head so that the facet runs concentrically true. It is not proposed to bore the tool holder sockets at this stage, because, although it might be possible, by meticulous measurement, to ensure that these would be in the correct position to line up with the lathe centres when the head is mounted on the slide, the more certain method is to bore them *in situ*. This operation cannot, however, be carried out just yet, as it will be necessary to rig up the traversing lever, so that the head can be fed up to the drill on its own slide.

The method which has been adopted for securing the tool holders in the sockets is similar to that used in the majority of capstan lathes, and consists of a vertical bolt, located so that it partly intersects the bore of the socket, and cut away so that it does not obstruct the bore. When the bolt is drawn endwise by its nut, the cut away portion exerts a powerful wedging thrust on the shank of the holder, and grips it securely. Some constructors may prefer to fit ordinary set-screws directly over the sockets, but though these may be satisfactory for most purposes, they are more liable to damage the holder shanks. Even if the screw holes are provided with brass or other soft metal pads between the screw-points and the holder shanks, they are not entirely satisfactory for continuous use, as the pads may become upset and jammed immovably in the holes, or on the other hand, they may fall into the sockets when the holders are removed, become forgotten and eventually lost. If the holder shanks are fitted very neatly in the sockets, any scarring caused by the screw points will cause them to seize ; and if fitted with sufficient clearance to avoid this eventuality, they will be forced out of centre when tightened, besides lacking in proper rigidity in the side plane.

(*To be continued*)

*I Take a Chance . . .

The Experience of an Amateur Who Turned Professional

By "Turner"

HAVING sufficiently established myself to have survived the first day, you may be sure that I kept open my eyes and ears. Many of the jobs which our department was called upon to do consisted of quite plain, straightforward turning, requiring nothing more than care with the micrometer, and presenting little difficulty. But there were other jobs which gave me a fit of the shudders to contemplate. Among these was one which was very prevalent—long lead screws for lathes and milling machines. These screws were of square or acme thread form, with pitches of from two to six threads per inch. Occasionally, a cross-slide screw of 8 or 10 threads per inch presented itself. But, worse than all, many of these lead screws had two and three start threads, and I would furtively glance at one of the turners engaged on such a job. A few words would serve to strike up a conversation as I watched the operations and leaned casually forward to inspect the formed cutting tool. I was learning all I could about the job against the inevitable time when I should be handed one of these multi-start screws.

Here it Comes !

One morning I saw it coming. There on my bench lay the ominous length of steel—4 ft. long by 1¼ in. in diameter. The charge-hand approaches with the old leadscrew as a pattern. He says : "One off," and I am left to my fate. Well, I'll have a go at it. I inspect the pattern. A table-screw from a Werner milling machine. A German, so a metric thread. Two-start, acme form ; ten millimeter lead ; left-hand. It really is two ten-millimeter threads, one running within the spiral of the other. The point is that the threads must be equally spaced, to within a thousandth of an inch at least. A two-"thou." error and the screw will not enter the nut—unless the nut is cut with a similar error. And some other turner will, most likely, cut the nut !

I had watched others doing the job, and had noted that the favourite system of spacing the threads was with a "test dial indicator," known in the shop as a "clock." The instrument consists of a clock-like dial, graduated in half-thousandths of an inch, over which moves a hand which is actuated by a plunger in the clock side. The whole is mounted on an adjustable stand. The system works as follows :

Let us assume that a screw is required of two threads, each four to the inch ; that is, with a ¼-in. lead. One thread is roughed out to within a few "thous." of the required depth. Then, without disengaging the lathe clasp-nut, the clock is rested on the lathe bed, with the plunger set against the top slide, with the indicator at zero. Now, the top slide is screwed forward against the clock plunger, until a reading of 0.1250 in. is obtained. This means that the tool has been advanced ⅛ in., so that it will now cut a thread ⅛ in. in advance of the first thread ; that is, exactly between two turns. And that is the system.

Upon the cutting of that thread I will not enlarge. Neither will I tell of the sudden beating of the heart, nor the catch of the breath as, for the twentieth time, I imagine I have spoilt the job. Using the broad, acme-shaped tool, which cuts on the points and the sides at the same time, there is grave danger of a "dig-in," and chatter is hard to avoid. Also, I am using a travelling steady (for the first time in my life) and it seems awkward, difficult to adjust, and obstructs the view. Since then I have cut many dozens of such screws, but few of them have been better than that first attempt ! I am quicker, that is all.

On one occasion I cut a six-start square-thread screw for an experimental machine. When the machine was completed, several of the "heads," who dwell mysteriously in a chrome-and-mahogany heaven, on the top floor, visited our shop to inspect the job. They are quiet men in good suits. They are the Olympians. They take no notice of you, and try to look omnipotent, as gods should. They are, nevertheless, conscious of their importance, even before we nonentities. I know how they feel ; in the past I have done it myself.

A Night Shift

One day I am told that I must go on night-work. I am to finish "days" on Saturday afternoon and start at 7 p.m. on Sunday. I try to sleep on Sunday afternoon, but I cannot. I lie restlessly, and worry about how tired I am going to be in the night ! It is absurd. My common-sense tells me that I must sleep, but a certain perversity of mind keeps me awake. It is too hot to sleep on that lovely autumn afternoon. The footsteps and voices in the street sound like a riot, and I realise how noisy are our peaceful English Sundays. So at last it is time to go to the factory.

Henceforth, my life is changed. It has become nearer to the elemental. Sleep, about which I normally do not think, now looms large in my scheme of things. When we greet each other at night, we say : "Hullo ! How did you sleep ? " It is not a joke. It is night-shift etiquette.

Der Blitz

There is the "blitz." Owing to the danger of congregating large numbers of people the canteen has been closed at night. We must cater for ourselves. I learn how good is a cup of tea at 3 a.m., made in a rather dirty billycan. I have seen tramps thus make tea by the roadside, and I now understand. And six-inch steel rules have another function ; they are invariably used as spoons.

By an unanimous vote the workers have decided that they will work through the air-raids. The shelters will be used only when imminent danger threatens. We have spotters who warn us when enemy 'planes are overhead. We have a system of signals by electric gongs. When they clang once it means that bombs are dropping in the vicinity, and we must immediately lie down on the floor. Clang ! That is the gong. Machines are snapped off, and down we crouch. Momentarily, we are scared, and I am trembling, but I hear the thud of the explosion, and the concrete building shakes. "That was a near one," says a voice. "Too— near," says another. But we are safe for the moment. Clang goes the gong, and we rise and resume work. "What a life ! " So far we have not been taken to the shelters, and we are wondering just what constitutes "imminent danger."

Not so Efficient

I am not so efficient on night-work, and others suffer in the same way. I am slower, and I make mistakes. So do the other turners. There is a satisfaction in the mistakes of others; somehow they seem to excuse your own.

We have been issued with steel helmets, which we wear during danger periods. Mine is uncomfortable, and weighs my head down with an unaccustomed swing whenever I bend it forwards or sideways. Also, I cannot take it seriously ; there is something ludicrous in working a lathe in a white smock and a "tin-hat."

* *Concluded from page* 286, "*M.E.*," *February* 10, 1941.

Night-work has some advantages. The pay is higher, it is more free and easy, and there are more facilities for making "foreigners." "Foreigners" are private jobs sneaked in to be done on the quiet. Parts of motor-cycles, and steering bushes for motor-cars, and such like. All firms suffer from these jobs with no order numbers. So far I have done no "foreigners"; the steering of my car seems quite all right so far. . . .

My job often takes me to other parts of the factory, where the machinery whirs, and the belts go: "Clop! Clop!"—"Clop! Clop!" as they pass over the pulleys. I am mostly taking measurements for some replacement part of some machine. Many of the machines are operated by girls. They work in a cursory manner, quickly, but appear preoccupied with other things. Unlike a man, they don't seem to "get into" a job. But they are very interested in the men, and give me a smile as I pass by. Many a romance flourishes in this clatter of belts and machinery. But that is another story.

Flogged Machines

Most of our repair work comes from the production shops. These are the shops devoted to the making of the firm's products. The workers form a fluctuating population of semi-skilled men. They are paid at piece-work rates; consequently, they flog the machines to the uttermost. I love machinery for its own sake, and it rends my heart. I have seen an operator milling thin slots in a bar of iron. He had four cutters mounted on the arbor of the milling machine, and was forcing the job through with an iron bar on the lead screw handle of the milling table, for leverage. And the cutters were blue with the heat. But nobody, not even the foreman, says a word. All is sacrificed to the great god—Production, and when a machine is racked out it has earned its money. Sometimes a new lathe will be "finished" in six months! Consequently, breakages and replacements are frequent.

Workmates!

In the tool room they tell this story of the production shops:—

A new bunch of machinists had been engaged, and a crowd of them were standing round the foreman's table, receiving their instructions. The foreman said:

"Well! You are all ready to start. Now, you know the class of work I want. I shall expect you to work with 'mike' and vernier. . . ."

At this point, a voice from the back of the crowd says:

"That's right, Guv'nor. We don't care who we work with, so long as they're sociable . . .!"

I do not attempt to explain the following phenomenon. For months I had been doing my job more or less satisfactorily. At least, I did not show up badly against the other turners. But every job had been a difficulty. At the back of my mind there had always been a thought: Can I do this job? Shall I spoil it? And only by dint of care and application had I succeeded at all. Now, one day, miraculously, I am confident. I am master of the machine, and I will tackle anything in my stride. Rather will I welcome the difficult jobs; they are more interesting than the child's-play of turning a bush to a "thou." limit! I work with my mind at peace.

One day I overhear a conversation between my workmates. Someone says:

". . . Yes, but what about old Henry . . .?"

My name is Henry, but I am not old. Yet, I find that among my work-mates I am known as "Old Henry." It is the sign of my success. I am accepted. I have arrived!

Letters

Model Electromotors

DEAR SIR,—Mr. Woodforde's article on the Froment Electromotor has interested me, and I have begun the construction of the model. It has also suggested what may be a new idea for a motor more closely resembling a steam engine. The difficulty in using an ordinary electro-magnet and its armature to provide the moving force, is the very short distance over which the action is effective: a more uniform pull over a much greater distance can be got by the sucking action of a solenoid, through which a current is passing on a cylindrical bar magnet inside it. The idea is to imitate a steam engine with a vertical double-acting slide valve cylinder. The cylinder would be a solenoid, and the piston a bar magnet inside it, provided with piston-rod, connecting-rod and crank, as in the steam engine. The piston could be suspended from a cord passing over a pulley and carrying a counterpoise equal in weight to the piston at the other end. The up and down movement of this counterpoise could be made to work a sort of slide-valve by means of suitably devised contacts, so as to turn the current on and off as required.

Perhaps Mr. Woodforde or some other reader of the "M.E." can say if this or a similar idea has been tried out. If it can be made to work, it would result in a very interesting and attractive model.

Yours truly,

Moulsford. P. K. TOLLIT.

1831

(*Continued from page* 327)

perfect equilibrium. For main axles 1 and 2, the temporary weight should equal quarter the connecting-rod weight in each case; and for No. 3 main axle, *all* the coupling-rod weight should be taken. If the permanent balanceweights provided on the wheels are not heavy enough, it is better to reduce the weight of the rods than attempt to increase the former; but if they are too heavy, holes drilled in the back of each weight, symmetrical about the plane of the crankpin, constitute the best method of adjustment. Note that it is of more importance to adjust the *total* amount of balance weight to correspond exactly with the weight of the rods, than to distribute the weight precisely in the prescribed proportions.

(*To be continued*)

The Islington Model Engineering Society

Meetings of the above society will be resumed on 4th May, and will be held every fortnight at Unity Hall, Upper Street, London, N.1, at 10.30 a.m. Will contributors to the "Bulletin" please note that the Editor's address is now, Miss M. Godfrey, Flat C, 5 Lisson Grove, N.W.1. New members are always welcome and full particulars may be had from Hon. Sec.: F. H. BRIGGS, 37, Blandford Street, Baker Street, London, W.1.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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